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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/817,145	04/02/2004	Thomas Schatz	INFMN-026	1178
48154	7590	03/21/2007		
SLATER & MATSIL LLP 17950 PRESTON ROAD SUITE 1000 DALLAS, TX 75252			EXAMINER THOMAS, MIA M	
			ART UNIT	PAPER NUMBER
			2609	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/21/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/817,145

Applicant(s)

SCHATZ ET AL.

Examiner

Mia M. Thomas

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-11 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-11 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 April 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date see attached.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- ☐ Notice of Informal Patent Application
- ☐ Other: ____.

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Drawings

2. The drawings are objected to under 37 CFR 1.83(a) because they fail to show a detailed example of the applicant's claimed invention as described in the specification. Any structural detail that is essential for a proper understanding of the disclosed invention should be shown in the drawing. MPEP § 608.02(d). Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the examiner does not accept the changes, the applicant will be

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notified and informed of any required corrective action in the next Office action.

The objection to the drawings will not be held in abeyance.

Specification

3. The disclosure is objected to because of the following informalities:

Summary of the Invention

[0002] In the production of masks for the ~~production~~ manufacturing of semiconductor components, stored design data ~~are~~ is converted for example, by means of an electron beam method into a structure on a substrate (e.g. chrome-on-glass). The patterning is followed by a measurement of the patterned mask during which the patterning errors, ~~in particular~~, are determined. Errors may occur in this case, in particular, in the case of the CD ~~dimension~~ of the mask (CD=critical dimension). The CD ~~dimension~~ specifies the feature size that can be produced during chip making. The mask may also have ~~solely or else additionally~~, a positional error of the structure ~~which~~ that is likewise measured.

[0004] If the errors of a patterned mask are to be measured, then it is important for the errors, in particular of the CD ~~dimension~~, to be determined independently of the positioning in the image field of the measuring unit.

[0006] Correction data determined on chrome-on-glass ~~are~~ is used in the production of the masks for the shorter wavelengths (e.g. 248 nm MoSi or 193 nm MoSi). Adopting these correction data values for the phase shift masks is disadvantageous in this case since the physical conditions of the mask structures and of the mask substrates are different.

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Object of the Invention

[0007] The present invention is provides a method for correcting imaging errors by means of which phase shift masks can also be correctly exposed.

[0008] b) a stored correction data record is selected,~~in particular~~ automatically, from a correction database in a manner dependent on at least one parameter for the characterization of the mask, then ...

[0009] It is ~~thus~~ therefore possible to employ precisely the correction data record which is specifically matched to the mask material respectively selected. This avoids the situation ~~e.g. for example~~, in which the correction data record for chrome-on-glass masks is also used for phase shift masks.

[0010] In this case, it is advantageous if the wavelength ~~at which~~ of the mask that is used in a photolithography method is also used as the parameter for the characterization of the mask.

[0015] In this case, a means serves for detecting at least one parameter for the characterization of the mask. A correction database has at least one stored correction data record, a data processing means serving for selecting the correction data, in particular automatically selecting, a correction data record from the correction database in a manner dependent on at least one parameter for the characterization of the mask.

[0016] The device can be used in particular for the measurement of CD ~~dimensions~~ and/or positional errors of a CoG mask or of a phase shift mask. The device can also be used for masks for use at wavelengths of 365 nm, 248 nm, 193 nm or 157 nm.

Detailed Description of the Drawings

[0020] FIG. 1 diagrammatically illustrates the elements which are necessary for carrying out embodiments of the method according to the invention. In this case, a mask 1 to be measured is illustrated diagrammatically on the right, the said mask having been patterned in a manner known ~~per-se~~ in the art.

[0021] The object is to detect the CD ~~dimensions~~ and/or the positional errors of this patterned mask.

[0025] The correction data record 21 contains tables ~~in which are stored~~ respectively store different correction values for the x and y directions.

[0027] A measuring system 30 subsequently determines optical properties of the masks 1 by determining CD ~~dimensions~~ and/or positional errors.

[0028] In a data processing device 40, the data obtained from the measurement ~~result~~ results are combined with the correction data record 21, i.e. the corrections are applied to the measured values determined.

[0030] This shows that the imaging ~~behaviour~~ behavior of the mask types ~~differs~~ differ, so ~~that~~ it is important to use the respectively appropriate correction data ~~record~~ records.

[0036] Rather, a number of variants are conceivable which make use of the method according to the invention also in the case of embodiments of fundamentally different ~~configuration~~ configurations.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims (1-5 & 8-10) are rejected under 35 U.S.C. 102(b) as being anticipated by Lehman (US 2003/0048939 A1).

Regarding Claim 1, a method for determining imaging errors of an optical system in the production of a mask for semiconductor component fabrication, the method comprising, “It is another feature of this invention to provide a method of reticle inspection...so as to be shared by various participants in the process of manufacture of semiconductor devices...” at paragraph [0019] a) detecting at least one parameter for the characterization of the mask, Figure 1, numeral 1, b) automatically selecting a stored correction data record from a correction database in a manner dependent on said at least one parameter for the characterization of the mask, Figure 1, numerals 3 and 4, “Indeed, what is involved here is the substitution of an image of a fully inspected and error free reticle, referred to herein as the “master” reticle, for the reference die or database information.” at

paragraph [0024] c) measuring optical properties of a structure of the mask using a measuring system, “Figure 1, numeral 6.5 and 7, d) combining measurement results associated with the measured optical properties with the correction data record associated with the mask in a data processing device to produce a corrected measurement result, and e) storing a measurement data record with the corrected measurement result in a database system, Figure 1, numeral 7, “Each pixel of the inspected image then is compared to corresponding pixels from the stored master image.” at paragraph [0037].

Regarding Claim 2, the method according to claim 1, wherein the parameter for the characterization of the mask is the wavelength at which the mask is used in a photolithography method, “Indeed, the inventive method and apparatus are equally applicable to inspection of masks, photo masks, reticles, or any other such product used in similar fashion in the manufacture of semiconductor devices, as for example by a photolithographic process.” at paragraph [0076]. “In such an inspection, interferometers could be used, especially where resolution on a wavelength scale is needed.” at paragraph [0068].

Regarding Claim 3, the method according to claim 1, wherein the parameter for the characterization of the mask is a substance property of the mask “Referring to Figure 1, the inventive method is implemented as follows. First, a reticle which is known to be good (i.e. is believed to be substantially free of defects, or as free of defects as is reasonably possible) is identified (step 1).” at paragraph [0030].

Regarding claim 4, the method according to claim 1, wherein the correction data record includes information for the correction of inhomogeneities of a radiation source, of the measuring system, in particular of at least one of an associated CCD chip and an optical element, “Transmission detector 370 and reflection detector 340 may be CCD devices...Light source 310 may be a pulsating laser, as part of the interferometry system, to facilitate inspection of phase shift masks, particularly in conjunction with area CCDs in detectors 370 and 340.

Regarding Claim 5, the method according to claim 4, wherein the optical element comprises a lens, “Light passing through the beam splitter 330 then passes through lens 345, and through article (e.g. mask, photomask, or reticle) 350 on an x-y stages 355 which permits transmission of light.” at paragraph [0071] .

Regarding Claim 8, the method according to claim 1, wherein at least one of CD values and positional errors are determined by the measuring system as said measured optical properties of the mask, Figure 2, numeral 220, “Memory 250 then provides the second binarized stream to compare unit 245.” at paragraph [0049]. As scanner technology and associated hardware technology progresses, it is expected that the inventive technique will be applicable for smaller pixel sizes, and hence to smaller geometries in reticles, photomasks, etc.” at paragraph [0056].

Regarding Claim 9, a device for determining imaging errors of an optical system in the production of a mask for semiconductor component fabrication, the device comprising: “...and apparatus are provided for inspection of articles

through comparison with an image of a master article, which is believed to be substantially free of defects.” at paragraph [0023], a means for detecting at least one parameter for the characterization of a mask, “In step 2, the master reticle (or die) is scanned to obtain a grey level master reticle (or die). The image of that scan is saved to some non-volatile storage device (step 3).” at paragraph [0031], a correction database with at least one stored correction data record, “Indeed, what is involved here is the substitution of an image of a fully inspected and error free reticle, referred to herein as the “master” reticle, for the reference die or database information.” at paragraph [0024] a data processing means for automatically selecting a correction data record from the correction database in a manner dependent on said at least one parameter for the characterization of the mask, “In the course of using the master reticle, the reticle to be inspected is identified (step 5), and the inspection is done relative to the master (step 6), again using unknown image processing, alignment, and correction techniques...” at paragraph [0037], a measuring system for determining optically measurable properties of the mask, “In Figure 2, a mask is scanned using optical subsystem 220.” at paragraph [0046], means for combining measurement results of the optically measurable properties of the mask with the correction data record associated with the mask to produce a corrected measurement result, “Each pixel of the inspected image then is compared to corresponding pixels from the stored master image.” at paragraph [0037], and means for generating a measurement data record with the corrected measurement result in a database system, “...the data can be retained on the DVD (e.g. in a “jukebox”), and directly inspected from

there; alternatively, it can be copied to a high performance file system from which the inspection is carried out.” at paragraph [0035].

Regarding Claim 10, the device according to claim 9, wherein said measuring system includes means for measuring at least one of CD dimensions, and positional errors of one of a CoG mask and a phase shift mask “The invention is not limited by the particular type of inspection apparatus being used. For example, it is within the contemplation of the invention to use the inventive MRI (Master Reticle Inspection) technique in connection with inspection of phase shift masks.” at paragraph [0068].

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lehman (US 2003/0048939 A1) in combination with Inoue (US 6656648 B2).

Lehman teaches the elements of Claims 1-5, and 8-10 as stated in the U.S.C. 102(b) rejection above. Lehman does not teach the device according to Claim 9, wherein the mask is designed for wavelengths of 365, 248, 193, or 157 nm respectively. **Regarding Claim 11**, Inoue teaches “In the experiment, the

imaging is performed by using, for example, a mercury lamp whose wavelength is 365 nm as the light source and using a CCD line sensor imaged by the objective lens of NA 0.75." at column 5, line 29. It would have been obvious to modify Figure 3, an electronics and computer subsystem 300, of Lehman to include the mercury lamp whose wavelength is 365 nm as the light source, as taught by Inoue. According to Lehman, Figure 3 shows light source 310, which outputs a beam which then enters the optic-scanner. Adding the mercury lamp whose wavelength is 365 nm, as taught by Inoue would provide the subsystem 300 as taught by Lehman with an analysis that may further prevents the errors of the optical correction device. The ability to correct the errors of the subsystem as taught by Lehman while using the domain of wavelengths as taught by Inoue will provide the optical system with microscopic details and improvements, and correspondingly will yield improved results in semiconductor manufacture.

7. Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lehman as applied to claims 1-5 and 8-10 above, and Lehman in combination with Inoue as applied to claim 11 and further in view of Udagawa et al (US 2004/0126673 A1).

Lehman teaches the elements of Claims 1-5, and 8-10 as stated in the U.S.C. 102(b) rejection above. The Lehman and Inoue combination teaches the elements of Claim 11 as stated in the U.S.C. 103(a) rejection above. Lehman does not teach, regarding Claim 6, the method according to claim 1, wherein the parameter for the characterization of the mask is identified by identification means, nor does Lehman teach regarding Claim 7, the method according to claim 6, wherein the

identification means comprises a bar code. Udagawa teaches **regarding claim 6**, “The reticle 10 also includes a band-shaped identification code 14 as in Figure 6(a). The identification code 14 serves to uniquely identify the reticle...” at paragraph [0025]. Udagawa also teaches, **regarding claim 7**, “Typically the identification code 14 is in the form of a bar code, which is the name used generally herein.” at paragraph [0025].

It would have been obvious to add the identification means, specifically a barcode, as taught by Udagawa to the device for determining imaging errors of an optical system in the production of a mask for semiconductor component fabrication of Claim 9 as taught by Lehman. “The identification code serves to uniquely identify the reticle, thereby facilitating control of the automated traffic of multiple reticles 10 into and out of the microlithography system.” at paragraph [0025].


Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mia M. Thomas whose telephone number is 571-270-1583. The examiner can normally be reached on Monday-Friday 7:30am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Brian Werner can be reached on 571-272-7401. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Mia M Thomas
Examiner
Art Unit 2609



BRIAN WERNER
SUPERVISORY PATENT EXAMINER